

Barriers to Sustainable Beverage Packaging

Noelle Shoda

Graphic Communication Department

College of Liberal Arts

California Polytechnic State University

2013

Approval Page

Title: Barriers to Sustainable Beverage Packaging

Author: Noelle Shoda

Date Submitted: June 2013

Dr. Xiaoying Rong, Senior Project Advisor _____

Dr. Harvey Levenson, Department Head _____

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Abstract

The purpose of this study was to determine the reasons for why a company would not implement beverage packaging with recycled content and/or bioplastic and whether or not size of a company plays a factor in its ability to implement sustainable beverage packaging. A face-to-face interview was carried out with industry professionals, as well as an email interview with a beverage company in order to gain insight from two perspectives regarding the main barriers to implementation and effect of size. Trends and companies within the beverage packaging industry were researched to discover what kinds of changes have been made, for what reasons, and the challenges in implementing such sustainable solutions. Research was used to make correlations between projections and responses collected from the four industry professionals interviewed and actual trends within the industry. The results of this study can be used to identify main barriers that prevent companies from implementing sustainable packaging so that additional research can be done to target each specifically in order to come up with solutions that will allow for more sustainable products in the future.

Introduction

Purpose of the Study

In order to maintain a healthy ecosystem and environment that will continue to provide vital goods and services, humans need to learn to live within their means in relation to human population size, biosphere robustness, resource stock, food supply, and environmental quality. Human wastefulness and failure to recycle has led to the huge landfills that exist today. When waste and plastic toxins decompose, methane gas is created. Such volatile organic compounds and other harmful toxins that enter the atmosphere add to the increasing air and water pollution problem. In 2008, the United States generated about 13 million tons of plastics in the Municipal Solid Waste (MSW) stream as containers and packaging (Willis, 2010). A huge part of that 13 million tons is plastic water bottles; Americans buy an estimated 29.8 billion plastic water bottles every year (Willis, 2010). It is estimated that out of every 10 of these bottles, 8 of them will end up in a landfill (Willis, 2010). If companies were to employ alternative materials in place of materials such as plastics, it can be ensured that less plastic will enter the waste stream and thus fewer toxins will be released to the environment.

This study focused on finding the reasons for why a company would not switch to more sustainable materials and the barriers that prevent companies from implementing such sustainable solutions. Specifically, it looked to determine the main barriers that influence a company's capability or willingness to produce sustainable packaging and whether or not these barriers are influenced by company size and type of consumer. By collecting data from beverage companies that target varying customers and of different sizes, one can determine the main barriers, as well as make connections between type of company and barriers.

Significance of the Study

Sustainable packaging is becoming a requirement for companies that wish to remain competitive. Companies that employ sustainable packaging report cost savings, improved environmental footprints, and a more positive brand image and reputation among other benefits (Katun, 2010). Climate change and sustainability once were the concern of only a few. However, today, increasing negative changes in the environment and increased awareness through developments in media and technology have made these issues significant to the general public. This increasing concern for the environment is influencing the way in which consumers view the companies from which they buy products and services. As consumer demands evolve to include the need for sustainable products, companies must evolve as well to meet those demands, not only to remain competitive, but also to work towards maintaining a healthy environment. Through identification of the main barriers that prevent companies from implementing sustainable packaging, additional research can be done to target each specifically in order to come up with solutions that will allow for more sustainable products.

Interest in the Study

As a Graphic Communication major with a concentration in Graphics for Packaging and a minor in Packaging, I am intrigued by the packaging industry for many reasons. The primary reason I was drawn to the packaging industry is the fact that packaging will always be necessary despite technological advances. Like any industry, it must evolve to continue to meet consumer demand and trends. However, the need for products that protect and contain will never diminish. Because sustainability is such a prominent issue in our world today, I am interested in further looking into how the industry has forced the evolution of packaging in terms of materials.

Literature Review

The ways in which humans live their lives contributes to the pollution and damage of the environment. When one drives a car, he is burning fossil fuels, which creates an overabundance of greenhouse gases and contributes to global warming (Cordero, 2011). Air pollution harms trees and plants, which absorb and filter dangerous pollutants such as dust, smoke, ash, and carbon dioxide. Their leaves can be damaged and branch growth is affected (Cordero, 2011). Pollution can even impair the process of photosynthesis, the process by which plants make food (Cordero, 2011). Use of chemical toxins find their way into rivers, streams, and oceans resulting in water pollution that can make water unsafe for drinking, cooking, and swimming (Scheid, 2013). These are just a few of the ways in which humans are negatively impacting the environment. In order to maintain a healthy ecosystem and environment that will continue to provide vital goods and services, humans need to learn to live within their means in relation to human population size, biosphere robustness, resource stock, food supply, and environmental quality.

Failure to recycle has led to the huge landfills that exist today. When waste and plastic toxins decompose, methane gas is created. Such volatile organic compounds and other harmful toxins that enter the atmosphere add to the increasing air and water pollution problem. In 2008, the United States generated about 13 million tons of plastics in the Municipal Solid Waste (MSW) stream as containers and packaging (Willis, 2010). A huge part of that 13 million tons is plastic water bottles; Americans buy an estimated 29.8 billion plastic water bottles every year (Willis, 2010). It is estimated that out of every 10 of these bottles, 8 of them will end up in a landfill (Willis, 2010). If companies were to employ alternative materials in place of materials such as plastics, it can be ensured that less plastic will enter the waste stream and thus fewer toxins will be released to the environment.

From the viewpoint of packaging companies, employing alternative materials that are environmentally friendly is important in satisfying the needs of customers. In a survey carried out by DuPont Corporation, 89 percent of the 700 participating customers agreed that delivering products with environmental benefits represents a long-term market opportunity (Pricewaterhouse Coopers, 2010). Today, it is not enough for a package to protect and contain; customers have high expectations that products do not cause environmental harm. They are concerned how products are made, what they are made from, how they travel, and how they are packaged (Pricewater Coopers, 2010). Companies must now respond with environmentally and socially responsible practices. In satisfying customers, companies are able to achieve two major goals, cost reduction and increased revenue. With reduced energy and material use companies will be able to reduce costs. In addition, commitment on issues such as water, energy, greenhouse emissions, waste, and toxic substances, will help meet customer demands.

History

The creation of the first man-made plastic in the 1860s has led to development of copious plastic products that hold a strong prominence in human everyday life. Five years after Alexander Parkes' invention of parkesine, the first man-made plastic, derived from organic cellulose, John Wesley Hyatt invented celluloid (National Public Radio, 2009). By using both cellulose and alcoholized camphor he was able to create the first flexible photographic film (Bellis, 2012). It was not until the early 1900s that the first completely synthetic, man-made plastic was made. Named Bakelite, this plastic was made from phenol, formaldehyde, and other materials and was able to retain shape and form under stress and heat (NPR, 2009).

Throughout the 1920s to the 1950s, inventors continued to create many different plastics

for a variety of purposes, which led to the evolution of a society marked by over-consumption and production of short-lived, disposable items. In 1920 polyvinyl chloride (PVC), used primarily for pipes and tiles, was commercially produced (Kiener 2010). In addition to polyvinyl chloride (PVC), commonly used plastics polystyrene (PS), polyethylene (PE), and polypropylene (PP) were invented (Kiener, 2010). These plastics are used for anything from containers for liquids, foods, and medicines to packing foam and packing peanuts (Kiener, 2010).

In the 1960s and 1970s, despite negative effects on wildlife, plastic bags gained global use especially with the invention of plastic shopping bags by Swedish engineer Sten Gustaf Thulin (Kiener, 2010). However, by the 1980s and 1990s, people began to recognize the potential damage of plastic products to wildlife and the environment. As a result, recycling gained in popularity and changes were made in hopes of reducing such damage. In 1988, the International Convention for the Prevention of Pollution From Ships treaty prohibited the dumping of garbage from ships at sea and Denmark introduced a tax on using plastic bags (Kiener, 2010).

The early 2000s has been a time of increasing awareness and concern for the environment. The general public is knowledgeable of the downsides of plastics including the fact that they are not biodegradable and contain chemicals that can be toxic to humans and the environment. As production of plastic resin pellets used to create plastics reached around 100 billion pounds a year, media began covering ocean plastic pollution, countries began banning and taxing plastic bags, and research on marine plastic pollution increased (Kiener, 2010). Increasing concern has led to demand for sustainable products, a huge part of which is packaging. Appealing to customers now needs to include offering sustainable solutions.

Problems With Beverage Packaging

One of the primary problems with food and beverage packaging today is the use of petroleum-based plastics. Up to 10% of total U.S. oil consumption is used for the production of conventional plastics (BioPlastics, 2011). As a result, as oil prices rise so does the cost of plastic materials, which is felt by consumers and businesses. In addition, oil is a nonrenewable resource that is highly energy- and resource-intensive to extract, transport, and refine (Santillo, 2010).

Conventional plastics are not only economically unsustainable, but are toxic to the environment and humans. When petroleum-based plastics are washed, heated, or stressed, they can leach into the foods and liquids humans consume. One such chemical that is leached is Bisphenol A (BPA) and phthalates, which are linked to hormone disruption and developmental disorders (BioPlastics, 2011). Another way in which toxic chemicals enter the human system is through the fish that they eat. Toxic chemicals such as DDT (dichlorodiphenyltrichloroethane), an organochloride insecticide or PCBs (polychlorinated biphenyl), chlorinated hydrocarbons, do not dissolve in water and can be absorbed by plastic (Hoshaw, 2009). This toxic plastic may be transferred from the plastic in the ocean to fish that we eat. Charles Moore, a captain, found what is known as the Pacific garbage patch, “an area of widely dispersed trash that doubles in size every decade and is now believed to be roughly twice the size of Texas,” collected hundreds of tiny lantern fish, which are consumed by larger fish like tuna and swordfish; more than 90 percent had plastic chips in their gut (Hoshaw, 2009).

Furthermore, conventional plastics are not truly biodegradable and therefore, have a long lifetime. While plastics are used for their ability to offer color, flexibility, durability, and resistance to degrading, the products for which they are used are meant to have extremely short lifetimes such as plastic bags and plastic bottles (Santillo, 2010). Every year, it is estimated about

260 million tons of plastic are produced; only 5 percent of this plastic is recycled because most types of plastic cannot be recycled economically (Project Kaisei, 2010). Plastic products in the United States are marked with a number from one to seven inside a triangle indicating which type of plastic resin was used to make the product. However, contrary to what many believe, the majority of these plastics are not recycled. In fact, because they are easier and cheaper to recycle, most jurisdictions only recycle number one, polyethylene terephthalate (PETE) and number two, high-density polyethylene (HDPE) (Kiener, 2010). Therefore, after disposal, those products numbered three through seven spend the rest of their lifetime as waste. Plastics account for a large portion of municipal waste volume. While some claim to be biodegradable, they only can be broken down to smaller microscopic pieces. However, the plastic still exists taking up space in landfills.

Alternatives to Conventional Plastic

Today there are many options to replace traditional plastic. Bioplastic is sourced from biomass and is typically made from plant matter such as vegetable starch, cane sugar, cellulose, and lactic acid (BioPlastics, 2011). From these materials one can make anything from clear food trays and containers to organic waste bags. Improvements in the area of bioplastic have led to the development and large-scale manufacture of a number of sustainable products.

One such product is Polylactic Acid (PLA). This plastic is made from vegetable starch and resembles plastic such as polyethylene terphthalate (PET) and polystyrene (PS). It is supposed to decompose into carbon dioxide and water within three months in a controlled composting environment. From PLA one can make products such as clear cold drink cups, coated paper cups, and fresh product packaging (BioPlastics, 2011). Polyhydroxyalkanoate (PHA) is another

alternative that is made from fermented corn sugar (Dell, 2010). It degrades more easily than PLA, however, it costs 20 to 50 percent more than petroleum-based plastic. Another bioplastic product is cellophane, which is plastic made from wood. Cellophane can be used for packaging film applications like sandwich wrap, food wrap, and transparent food bags (Bio Plastics, 2011).

Biodegradable plastic bags come in three varieties: photo-degradable, hydro-biodegradable, and oxo-biodegradable. Photo-degradable plastic breaks down under ultraviolet light, hydro-biodegradable plastic breaks down in biologically active environments such as compost, and oxo-biodegradable plastic breaks down with additives and exposure to the atmosphere. However, unique recycling and a specific degrading process are necessary for each bioplastic in order to be beneficial. For example, according to a Florida Department of Environmental Protection report, “A photo-degradable bag will not break down if it is covered by water or otherwise obscured from light, and an oxo-biodegradable bag requires direct access to oxygen and sunlight to degrade” (2010).

Benefits of Bioplastic

Bioplastic products are usually made from renewable raw materials such as starch, cellulose, soy protein, and lactic acid. These raw materials are not hazardous or toxic and can decompose back into carbon dioxide, water, or biomass when composted (World Centric, 2013). Recycling of materials ensures that they are reintroduced into the industrial chain cycle and may be reused for another purpose thereby reducing strain on Earth’s depleting resources. This cycle works to reduce waste in landfills minimizing the negative atmospheric and hydrological effects. These compostable resins mimic plastic properties in relation to heat resistance, tensile strength, impact resistance, and oxygen barrier properties (World Centric, 2013). Using renewable

resources for the production of bioplastic reduces dependence on petroleum. As oil prices rise so does the cost of plastic materials, which is felt by consumers and businesses. If one can reduce oil dependency, he can hope to achieve environmental sustainability and economic sustainability.

Barriers to Implementing Sustainable Packaging

Despite the benefits of bioplastic and demand for sustainable packaging from consumers, not all companies are choosing to implement alternative materials. These barriers to implementation may be cost, compromising the package's protective qualities, possible contamination, and difficulty recycling and composting. Cost is a huge reason for which a company may not want to stray from conventional plastics. For example, PLA was made in hopes to replace petroleum-based packaging and containers. However, it costs 20 to 50 percent more than petroleum-based plastic (Dell, 2010). PHA is another bioplastic that costs more to produce, about twice as much as petroleum-based plastics (Dell, 2010).

In addition to cost, a company may be worried whether minimizing material weight or thickness of a package or switching from conventional plastic to bioplastic will compromise the protective qualities of the package. When creating a package, proper material selection and weight is necessary for suitable physical and barrier protection. However, because bioplastics are made from different materials, they possess different qualities. For example, plant-based bioplastics have a low melting point (Parpal, n.d.). Therefore, if one were to leave a corn-based container in the car on a warm day, they may find that it has melted when they return (Parpal, n.d.).

Because bioplastic is made typically from plant matter such as vegetable starch, cane

sugar, and cellulose, there is a possibility for contamination. For example, planting corn for non-food uses can be problematic because most corn that is planted for industrial use is genetically modified, which can lead to potential contamination of conventional crops (Parpal).

Another downfall to producing bioplastic is its difficulty being recycled and composted. Because bioplastics require a specific recycling and degrading process, they cannot be recycled in conjunction with petroleum-based products, which makes sorting very critical (Parpal, n.d.). However, new ways of sorting could solve this problem. For example, Japanese scientists have developed a robot that uses lasers to identify and sort six different types of recyclable plastic (Demetriou, 2010). In addition to difficulty recycling and sorting, recycling centers are not set to handle large amounts of bioplastic such as PLA products (Parpal, n.d.). In addition, bioplastics are compostable, but only under specific conditions. In order to biodegrade within 90 days, the products have to reach 140 degrees Fahrenheit for 10 consecutive days. This requires a special facility, which few consumers have access to (Parpal, n.d.).

Methodology

The purpose of this study was to determine the main barriers that prevent beverage packaging companies from implementing sustainable packaging. The goal of this research was to determine whether or not these barriers are influenced by company size and properties of the packaging material.

An in-depth research study was conducted on four beverage companies and four industry professionals in order to gain insight from two different perspectives. The four beverage companies were differentiated by size of the company and the type of products they produce. Two of the four companies were classified as small in size and the other two were classified as large based upon the number of employees they have. The results were used to determine if company size has an influence on its ability to implement sustainable solutions. Size may determine the capabilities a company has in implementing new solutions. Therefore, it is beneficial to note any connections between particular barriers and size of the company to determine possible solutions. All industry professionals are professors at California Polytechnic State University, San Luis Obispo. Two of the professors who participated in the study were professors in the Graphic Communication Department and the other two professors who participated in the study were professors in the Industrial Technology Department.

Each of the four companies was contacted separately via email and asked to participate in the study. Out of the four companies, only one company replied. A series of eight questions was given to the company in order to collect qualitative data (Appendix B). They were asked to list the types of beverage products they produce, what these products are made of, and what process is used to make them. Additional questions were asked related to the reasons for why they have chosen or have chosen not to implement bioplastic or other sustainable materials and reasons for why a company would consider using alternative materials. Lastly, they were asked to determine

the number of employees they have and respond as to whether or not the size of their company plays a factor in their ability to implement more sustainable packaging in the form of recycled plastic or bioplastic and for what reasons.

In addition to contacting beverage companies, a professional face-to-face interview was carried out with each industry professional, where qualitative data was collected through a series of questions related to the current status of the beverage packaging industry in terms of implementation of recycled plastic and bioplastic solutions (Appendix A). In order to determine the current status of the beverage packaging industry, questions were asked about the use of conventional plastic and the use of recycled plastic and bioplastic in regards to the most common types of materials used, the process used to make them, as well as the qualities of the material that make them suitable for beverage packaging. Questions focused on the reasons for why companies may not choose to use recycled plastic or bioplastic, as well as reasons for why a company would. After discussing some of the main barriers to creating sustainable beverage packaging, additional questions were asked to determine whether or not factors, such as the size of a company play a factor in a company's ability to implement more sustainable packaging. The study was conducted over a period of two weeks, and each industry professional participated in the study independently from one another.

In order to better understand the movement towards sustainable beverage packaging and the challenges and opportunities it presents for beverage companies, research was carried out to determine what specific beverage companies have changed in terms of materials and design of their products over the past ten years. Companies of varying sizes were researched in order to draw conclusions between size of a company and ability to implement sustainable beverage packaging. In addition, research was used to make correlations between projections and

responses collected from the four industry professionals interviewed and actual trends within the industry. This was done by looking at existing examples of companies and determining what kinds of changes have been made, for what reasons, and the challenges in implementing such sustainable solutions.

Results and Discussion

Overall, responses from interviews with California Polytechnic State University, San Luis Obispo professors Colleen Twomey, Dr. Malcolm Keif, Dr. Koushik Saha, and Dr. Jay Singh were similar. All believed that cost, difficulty of recycling bioplastic, and difference in properties stand as barriers to implementing sustainable beverage packaging, specifically bioplastic. While almost all companies use at least a percentage of recycled plastic in their beverage products, a very small number utilize bioplastic. Big companies like Coca Cola and Pepsi are paving the way for bioplastic solutions. However, all agreed that larger companies like Coca Cola and Pepsi are better able to implement bioplastic packaging due to their ability to bear significant costs more easily and increased purchasing power. While the use of bioplastic within the beverage packaging industry is very small, there is huge market opportunity for the future.

Industry Professional Responses

1. What types of materials are used in beverage packaging?

There are a variety of different materials used in beverage packaging. When speaking of plastic bottles such as those used for water and carbonated drinks, PET (polyethylene terephthalate) is the most prevalent in single use carbonated and uncarbonated beverages (Keif, Saha, Singh, Twomey, 2013). PET is commonly used due to its high recyclability and ability to be made back into a plastic bottle (Twomey, 2013). PET is also suitable for carbonated beverages specifically (Keif, Singh, 2013).

Other types of materials used include HDPE (high density polyethylene), PP (polypropylene), and Nalgene. HDPE is used in products such as juice and milk gallon bottles and Nalgene is used in reusable water bottles (Singh, 2013). While not a beverage

specific product, Coca Cola has a campaign in Atlanta in which all employees of the Atlanta Braves stadium wear recycled polyester clothing (Twomey, 2013). This represents beverage companies' efforts towards a green initiative and promoting sustainability. Companies such as Coca Cola and Pepsi have also implemented a plant-based bioplastic bottle (Twomey, 2013). Bioplastic is growing in use and provides a greener alternative to conventional plastic.

2. What qualities do they have they make them suitable for beverage packaging? For the specific product? (carbonated drinks, juice, water, milk)

PET is a commonly used polymer for single use carbonated and uncarbonated beverage products due to its clarity, flexibility, strength, and recyclability (Keif, Singh, Twomey, 2013). PET has great transparency, which is important for aesthetic purposes when reaching out to consumers (Keif, Singh, 2013). Its flexibility is especially important when working with carbonated drinks, where the material needs to be able to expand (Keif, 2013). Bottles must be able to resist puncture and other potential threats to the product inside making strength an important quality of PET. PET is also highly recyclable and can be used again for future bottles (Twomey, 2013). Many single use carbonated and uncarbonated beverage products are made of a percentage of recycled PET. PET is also relatively cheap when buying in volume and is deemed as a safe material to drink out of by the government (Twomey, 2013). Another quality that is important to consider for any beverage product is permeability (Singh, 2013). Exposure to outside forces such as oxygen can affect the product within and cause it to spoil at a faster rate.

3. What process is used to make them?

There are two main processes that are used to make beverage packaging products, injection molding and extrusion blow molding (Keif, Singh, Twomey, 2013). Injection molding is the most commonly used process.

4. What is the most commonly used bioplastic?

The most commonly used bioplastic is PLA (polylactic acid or polylactide), which is a corn starched based thermoplastic (Keif, Singh, 2013).

5. Are packages made of recycled plastic and bioplastic made using the same process as conventional plastic?

Beverage products made of recycled plastic and bioplastic are made using the same process as conventional plastics (Keif, Singh, 2013). However, in using recycled plastic or bioplastic, machine settings will most likely need to be changed (Singh, 2013).

6. What percentage of beverage companies would you say are using recycled material and/or bioplastic?

Exact percentages could not be given in regards to the percentage of beverage companies that use recycled materials and/or bioplastic. However, Professor Colleen Twomey and Dr. Jay Singh agreed that almost 100% of beverage companies use recycled content in their bottles, at least the big brands. This is especially true of big brands that have recycled environmental stewardship goals and cannot put out a bottle without recycled content (Singh, 2013). Big manufacturers are always looking for ways

they can carry out more green processes (Keif, 2013).

The percentage of beverage companies using bioplastic is very small; Dr. Jay Singh estimates less than five percent of companies are using bioplastic and even so, not exclusively (Twomey, Singh, 2013). Although a very small percentage of companies are using bioplastic, a good amount of investment is going into bioplastic technologies (Twomey, 2013). For example, there are companies that are investing in building huge plants in Brazil where there is a lot of manufacturing and in growing corn and other materials specifically for bioplastic packaging (Twomey, 2013).

7. How does the use of recycled plastic or bioplastic affect the properties of the bottle?

There are several properties that are altered when using recycled content. One noticeable difference is in the color of the bottle. Bottles containing more recycled content will appear more blue due to the degradation of the polymer molecules (Singh, 2013). For many companies, such as Pepsi and Coca Cola, this greatly affects the visual appeal of the bottle. Therefore, they choose to use a lower percentage of recycled content so as to not lower the image and visual appeal of their bottle (Singh, 2013). Other properties that are changed include lower permeability and different processing needs including different temperature settings (Singh, 2013).

The same is true of using bioplastic. Using bioplastic rather than conventional plastic can affect the permeability, stackability, puncture and scratch resistance, melt strength, and printability. As in using recycled content, when using bioplastic the permeability is lowered (Singh, 2013). Bioplastics such as PLA also do not have good strength and have a much lower glass transition temperature and melt temperature than

PET (Saha, 2013). Therefore, it will degrade and lose its integrity at lower temperatures (Saha, 2013). Bioplastic's inferior strength also affects its stackability and reduces its resistance to puncture and scratching (Singh, 2013). Furthermore, plant based materials such as PLA tend to be very loud, which not only affects printing and converting, but the user experience as well (Twomey, 2013). Other properties that are important in beverage packaging include rigidity, sealability, weight, and sterilization and may be affected by the use of bioplastic (Twomey, 2013).

8. What are reasons for why a company may not use recycled plastic?

As mentioned in question number seven, using recycled plastic affects the visual appeal of the bottle by making it appear color tinted and not clear. Many companies are not willing to compromise the appeal of their bottle. However, many utilize a percentage of recycled content that does not compromise the appeal of the bottle. Other reasons a company may not use recycled plastic include increased cost, compromising the package's protective qualities such as weight and thickness, possible contamination, and difficulty recycling and composting (Singh, 2013). The use of rPET, or recycled PET, is more expensive and may require more experimentation due to lack of familiarity with the resin (Singh, 2013). When putting material other than 100% PET into recycling streams, it can create difficulties in the recycling process and can contaminate the recycling stream because rPET bottle regrind is not as effective as PET (Saha, Singh, 2013).

9. What are reasons for why a company may not use bioplastic?

One of the biggest reasons for why a company may not use bioplastic is the cost,

not only for the cost of materials but also the cost of investment in new technology.

Because companies experience increased costs, they must increase the price of the product and often times the consumer cannot bear the cost (Twomey, 2013). Investing in a new technology and material one is unfamiliar with requires a great deal of experimentation that some companies cannot afford to undergo (Singh, 2013).

Another issue that stands as a barrier to implementing bioplastic is the availability of resources (Twomey, 2013). For example, if a large company such as Coca Cola were to decide to make their bottles out of an entirely new material, they would have to have the resources for all the volume they produce and the plants used may not be able to handle the volume they require (Twomey, 2013).

A third barrier to implementing bioplastic is difficulty in recycling. Currently, bioplastics do not have a separate recycling stream (Keif, Saha, Singh, 2013). Therefore, if bioplastics make their way into PET recycling streams, they will contaminate and pollute the stream (Keif, Saha, Singh, 2013).

Other reasons a company may decide not to implement bioplastic can be related to changes in the properties of the bottle mentioned in question number seven. Using bioplastic rather than conventional plastic can affect the permeability, stackability, puncture and scratch resistance, melt strength, and printability.

10. What are reasons for why a company would decide to use recycled plastic or bioplastic?

One reason a company may decide to use recycled plastic or bioplastic is that they feel it is their social responsibility to be a good steward of the Earth (Keif, Twomey, 2013). By using recycled plastic or bioplastic, one can help reduce the amount of plastics

in landfills and determine new ways to dump less material into landfills (Keif, 2013). As the general population becomes more aware of plastics' effects on the environment, more and more consumers are making efforts to increase environmental sustainability in their purchasing decisions. With this in mind, companies are hoping that by producing products that are more environmentally sustainable, consumers will have a better perception of their brand and will buy more (Singh, Twomey, 2013). Another reason that companies may implement more sustainable solutions is the push from constituencies and non-governmental organizations to help better the environment (Twomey, 2013).

11. Does the size of a company play a factor in one's ability to implement more sustainable packaging?

Size of a company can play a factor in its ability to implement more sustainable packaging whether the company is large or small. Larger companies such as Coca Cola and Pepsi have the resources needed and are able to experiment on a larger scale because they can bear significant costs more easily (Singh, Twomey, 2013). In implementing a new material and technology, most companies cannot afford to experiment with unfamiliar technology.

On the other hand, in some cases smaller companies may have more room to experiment because they are more nimble (Keif, Twomey, 2013). It might be the case that sustainability is part of their demographic and they can offer a niche product line (Twomey, 2013). A company like this may find it easier to pass along increased costs because they know their target market will buy more sustainable products (Twomey, 2013).

12. From a financial standpoint, where is profit generated through switching from conventional plastic to recycled plastic or bioplastic, if at all?

By switching from conventional plastic to recycled plastic or bioplastic, companies have the opportunity for increased sales as they take on a new, more sustainable brand image (Singh, 2013). Companies will be able to compete and better differentiate themselves from competition by offering sustainable solutions where others do not (Twomey, 2013). If consumers are responsive to greener products and feel they would purchase more sustainable products at a higher price, companies may either raise product price or increase production volume, thus leading to increased sales (Twomey, 2013). It is also possible that profit is not generated through switching from conventional plastic to recycled plastic. Dr. Malcolm Keif believes that right now, there is no direct financial benefit in switching to bioplastic. The benefit right now is more about feeling that it is one's social responsibility to be a good steward of the Earth (Keif, 2013). Because the use of bioplastic in the beverage industry is still in its early stages, it is possible that in the future one will see more of a financial benefit in switching from conventional plastic to bioplastic.

Beverage Company Responses

In order to gather first-hand information from beverage companies regarding why they have or have not implemented sustainable beverage packaging, as well as whether or not their size plays a factor in their ability to implement more sustainable packaging, beverage companies of varying sizes were contacted via email with an attached set of seven questions (Appendix B). Out of the four companies contacted, only one company was able to answer the given questions,

Honest Tea. Honest Tea is a bottled iced tea company founded by Seth Goldman and Barry Nalebuff. The company has been named one of The Better World Shopping Guide's "Ten Best Companies on the Planet based on their overall social and environmental record" and listed as one of PlanetGreen.com's "top 7 Green Corporations of 2010." Also in 2010, The Huffington Post ranked Honest Tea as one of the leading "8 Revolutionary Socially Responsible Companies." Below is Honest Tea's mission statement, which represents what their purpose is and what they value.

Honest Tea seeks to create and promote great-tasting, truly healthy, organic beverages.

We strive to grow our business with the same honesty and integrity we use to craft our products, with sustainability and great taste for all.

Below are responses from the Director of Honest Tea.

1. What types of beverage products do you produce?

Honest Tea produces Iced Tea (Honest Tea), Juice Drinks (Honest Ade, Honest Splash, Honest Kids), and Carbonated Soft Drinks (Honest Fizz).

2. What type of material(s) are your products made of?

By product line...

- Tea, Ade, Splash: Single Serve in PETE plastic bottles
- Tea & Ade variety packs are 12 PETE bottles in LDPE plastic shrink wrap
- Splash variety packs are 6 PETE bottles in LDPE plastic shrink wrap
- Tea: Single Serve in glass bottles
- Kids: single serve is in a film pouch; sold in cardboard cartons of 8 pouches
- Fizz: single serve is in aluminum cans; sold in cardboard cartons of 6 cans

3. What process is used to make them?

The packaging of Honest Tea's products is made using injection molding.

4. Do you use either recycled plastic and/or bioplastic?

All of our materials have some portion of post-consumer recycled content:

- Plastic: up to 10% recycled
- Glass: 25% recycled
- Aluminum: on average 70% recycled
- Cartons: up to 30% recycled

None are 100% recycled. None are bioplastic.

- a. If so, what are the main reasons for why you have chosen to do so? What are the main reasons why a company may not choose to use recycled plastic and/or bioplastic?
- b. If not, what are the main reasons why you have chosen not to?

One of the main reasons Honest Tea does not use 100% recycled plastic is because it is not possible to make a clear bottle out of 100% recycled plastic.

Because the company is very open about its ingredients and the quality of the beverage, it is important to them that consumers can clearly see the beverage inside. With that said, Honest Tea uses the maximum amount of recycled content while still meeting their aesthetic, quality, and safety standards.

In terms of bioplastic, Honest Tea is actively working towards moving to a bioplastic bottle. However, due to their tea brewing process, it has not been commercially feasible at this time.

5. How many employees do you have?

Honest Tea has 115 employees.

6. Does the size of your company play a factor in your ability to implement more sustainable packaging in the form of recycled plastic or bioplastic? How?

Honest Tea believes that company size can play a factor in its ability to implement more sustainable packaging. In relation to ingredients and materials in the supply chain, larger companies benefit from the lower costs and prices that come with higher volumes of product sold. Honest Tea must ensure prior to adopting a new material that it is financially viable within their costs and pricing structure. Because their size and volume are smaller than large companies, they do not have enough influence to bring costs down to a feasible level. However, overall they continually try to factor sustainability into their packaging explorations weighing it against many factors including cost, safety, retail environment, consumer acceptance, and brand fit before making a decision.

7. From a financial standpoint, where is profit generated through switching from conventional plastic to recycled, if at all?

Because the company does not use 100% conventional plastic or 100% recycled material, it is difficult to determine profit generated through switching. In terms of the amount of recycled content used, it depends on the availability of recycled content and the ability to make a quality and safe beverage container. Honest Tea themselves does not determine the amount of recycled content for specific PET packages they source; it is

their packaging suppliers that determine the right amount of recycled content. There is no indication that they can increase the recycled content without compromising the material standards. They believe, in theory, they might see an increase in sales if they were to move to bioplastic. However, sourcing bioplastic would also increase their material costs. Therefore, they cannot say for sure if they would see any difference in switching from conventional plastic to recycled plastic from a profit standpoint.

Parallels Between Industry Professional Responses and Honest Tea Responses

From the responses given by Honest Tea, one can draw parallels between industry professional knowledge and projections with real world companies like Honest Tea. Just as all four industry professionals interviewed named PET as the most commonly used material in single use carbonated and uncarbonated beverages, Honest Tea uses PET in many of its products including its Tea, Ade, and Splash single serve bottles, Tea & Ade variety packs, and Splash variety packs. Honest Tea also uses the injection molding process to make their bottles, which was named as the most common manufacturing process for beverage packaging by Dr. Jay Singh.

Honest Tea is a company that uses recycled content in all of its products. However, as stated in question seven of the industry professional responses, using 100% recycled content affects the clarity of the bottle, which is an important property when thinking of the visual appeal and brand of the product. Therefore, Honest Tea does not use 100% recycled content, but uses up to 10% recycled plastic in its beverage products. It is important to the company that their consumers can clearly see the beverage inside, as they are transparent about the ingredients and quality. Just as Dr. Jay Singh mentioned companies like Coca Cola and Pepsi do not want to

lower the image and visual appeal of the bottle by noticeably changing its clarity, Honest Tea uses the “max amount of recycled content possible while still meeting their aesthetic, quality, and safety standards” (Honest Tea, 2013).

While Honest Tea uses recycled content in all of its products, it is not one of the very few companies that uses bioplastic. There are several barriers that prevent Honest Tea from implementing bioplastic at this time, some of which line up with the responses given by the industry professionals interviewed. Honest Tea is actively working towards moving to a bottle made out of bioplastic, but is not able to at this time given its tea brewing process.

Honest Tea has also expressed that its size plays a factor in its ability to implement more sustainable packaging. As mentioned by Dr. Jay Singh and Professor Colleen Twomey, larger companies often have the benefit of having access to resources and the ability to experiment on a larger scale because they can bear significant costs more easily. Similarly, the Director at Honest Tea expressed that larger companies benefit from the lower costs and prices that come with higher volumes of product sold (Honest Tea, 2013). They have to make sure that new materials are financially viable within their cost and pricing structure before adopting such technology (Honest Tea, 2013). Because they are smaller, with only 115 employees, their size and volumes are such that they do not have enough influence to bring costs down to a level where they could implement such packaging (Honest Tea, 2013).

Similar to the responses given by Professor Colleen Twomey, Dr. Malcolm Keif, and Dr. Jay Singh, there is potential for increased sales in switching to recycled plastic or bioplastic, however, one cannot say for sure. Honest Tea believes in theory they might see an increase in sales if they were to move to bioplastic, but takes into account the increase in material costs. Therefore, they also cannot say for sure whether or not they would see any difference.

Trends Within the Beverage Packaging Industry

In the past ten years, there has been a huge growth in the use of bioplastic and bioplastic production due to volatile oil prices and growing concerns over greenhouse gas emissions. According to a study carried out in 2011 by the University of Applied Sciences and Arts at Hanover in Germany for trade association, European Bioplastics, predicted global bioplastics production capacity will reach 1.7 million tons by 2015, which will more than double the 2010 capacity levels (“Why green,” 2012). However, a changing trend in the bioplastics industry is that traditional biodegradable and compostable polymers will see modest growth while bio-derived versions of today’s existing petrochemical plastics will make up the majority of production capacity in 2015 (“Why green” 2012). A number of companies are finding ways to use bioplastic in their existing products such as Toyota, who used DuPont’s bio-based Sorona polyester for its air vent louvers on its latest Prius and AT&T, who used up to 30% plant-based materials sourced from sugarcane ethanol in its device cases and power accessories (“Why green,” 2012). Bioplastics have only captured 1-2% market share of total plastic usage (Timm, 2012). However, with more and more brand owners pushing towards bio-based plastics, as well as regulators moving to incentivize investment in these new technologies, one is expected to see this percentage grow (“Why green,” 2012).

The beverage industry is an industry where large efforts have been made to reduce the use of conventional plastic. Companies such as Coca Cola and Pepsi have developed bio-based technologies to replace their current PET bottles. In 2009, Coca Cola began selling Dasani water in the United States in bottles made with up to 30 percent plant-based plastics (Neuman, 2011). The company projects that by 2020 all of its plastic bottles will be made of 30 percent plant-based plastics (Neuman, 2011). In its first year, Coke’s PlantBottle was launched in nine global

markets, including Brazil, Canada, Chile, Denmark, Japan, Mexico, Norway, Sweden, and the United States. Coca Cola is also working with Gevo and Avantium to develop the all plant soda bottle. Currently soda bottles are made out of PET, which is commonly made up of MEG (mono-ethylene glycol), which makes up about 30 percent of the bottle's weight, and PTA (purified terephthalic acid), which makes up about 70 percent of the bottle's weight (The Coca-Cola Company, 2012). Coca Cola has been able to produce MEG from plant sources using sugarcane grown in Brazil (Neuman, 2012). However, while scientists have also been able to make PTA from plant materials in the laboratory, producing the material on an industrial scale has been difficult and stands as a barrier to producing a 100% plant-based bottle (Neuman, 2012). Meanwhile, they are combining plant-based MEG with recycled PET in order to maximize the package's environmental performance (The Coca-Cola Company, 2012).

Coca Cola has developed a 100% renewable HDPE (high density polyethylene) plant bottle under its brand Odwalla. The Odwalla bottle is able to be 100% plant-based because there is only one material used to make PE (Polyethylene), which is ethylene. Today, ethylene can be made from sugarcane based ethanol (The Coca-Cola Company, 2012). While HDPE is suitable for juices, it is not for carbonated beverages because of its high gas permeability (The Coca-Cola Company, 2012). HDPE also cannot be used for Dasani and other bottled waters because it is not clear (The Coca-Cola Company, 2012).

Coca Cola has chosen to implement a bioplastic bottle for a number of reasons. While the company has been using PET plastic for the past thirty years because of its versatility, durability, low-cost, re-sealability, and high recyclability, it recognizes that most PET plastic beverage bottles are petroleum based, which leads to waste (The Coca-Cola Company, 2012). Because the company makes zero waste its goal, they are actively working to prevent waste

through consumer recycling programs and increasing use of recycled and renewable material in their beverage bottles (The Coca-Cola Company, 2012). Coca Cola also sees a bioplastic bottle as an ability to strengthen their brands' connections to customers and consumers (The Coca-Cola Company, 2012). In switching from conventional plastic to plant-based plastics, Coca Cola believes the cost of plant-based material will be more stable than the price of petroleum used to make conventional plastics (The Coca-Cola Company, 2012). However, at this time, they are absorbing the additional costs in order to fulfill their sustainability goals. Ultimately, the company aims to be a leader in sustainable packaging innovation in which they advance technologies that allow an increase in the amount of recycled and renewable material in their packaging (The Coca-Cola Company, 2012).

While the use of plant-based plastics generates smaller amounts of greenhouse gases in comparison to petroleum-based plastics, one must also consider the source of the plant material, which also has an environmental impact. According to Allen Hershkowitz, a senior scientist at the National Resources Defense Council, using agricultural waste products, such as corn stalks and other left over materials from farming is better than using crops, such as sugarcane or corn that are grown specifically for plastic production, which causes a lot of land conversion, affects the price of food, and uses a lot of fertilizers (Neuman, 2012). This may affect availability of resources for the company, who produces a large volume of products that will require a large volume of material.

Another big company that is working towards developing a plant-based bottle is PepsiCo. Pepsi, like Coke, is committed to protecting the earth's natural resources every day (PepsiCo, 2012). In their packaging, they work to deliver new designs that reduce the amount of packaging used in order to eliminate solid waste sent to landfills. In March of 2011, Pepsi unveiled a 100%

plant based bottle. The bottle is made from switch grass, pine bark, corn husks, and other materials (“PepsiCo Unveils,” 2011.) Eventually Pepsi would like to also use orange peels, oat hulls, potato scraps, and other leftovers from its food business (“PepsiCo Unveils,” 2011). Despite being made of 100% plant-based material, the bottle looks, feels, and protects the beverage inside exactly the same as its current bottles made of conventional plastic (“PepsiCo Unveils,” 2011). Because Pepsi is one of the world’s largest food and beverage businesses, it is in the position to source agricultural byproducts from their own food business to manufacture a more “environmentally-preferable” bottle (“PepsiCo Develops,” 2011).

Pepsi has also taken steps to reduce its environmental impact through its Naked Juice line and Aquafina bottle. In 2010, Naked Juice converted all of its 10, 15.2, and 64 ounce juices and juice smoothies to bottles made with 100 percent post-consumer recycled content (“Naked Juice,” 2010). Pepsi subsidiary projected that the switch would avoid using 7.4 million pounds of virgin plastic a year, save the equivalent of 57,000 barrels of oil per year, and would result in 35 percent fewer packaging-related greenhouse gas emissions (Horovitz, 2009). Pepsi’s Aquafina bottle was also altered in order to create a more sustainable bottle. The new Eco-Fina Bottle utilizes 50% less plastic than their 2002 bottle and is now flexible, lightweight and sturdy (PepsiCo Inc., 2012).

Parallels Between Industry Professional Responses and Industry Trends

By researching different beverage companies and the changes they have implemented in the past ten years, one can draw parallels between industry professional knowledge and projections and what kinds of changes have been made, for what reasons, and the challenges in implementing sustainable packaging. Just as mentioned by Dr. Malcolm Keif and Professor

Colleen Twomey, one of the main reasons why companies are choosing to use recycled content and bioplastic is because they feel it is their social responsibility to be a good steward of the Earth. Coca Cola makes zero waste its goal and strives to be a leader in sustainable packaging innovation by continuing to advance technologies that allow them to increase the amount of recycled and renewable material in their packaging. Their ultimate goal is “a carbon, neutral, 100% renewable, responsibly sourced bottle that is fully recyclable” (The Coca-Cola Company, 2012). Pepsi is also committed to protecting the earth’s natural resources everyday. For this reason they are driven to deliver new designs that reduce the amount of packaging used in order to eliminate solid waste sent to landfills. According to Dr. Jay Singh and Professor Colleen Twomey, beverage companies are also driven to implement sustainable beverage packaging because they hope that by producing products that are environmentally sustainable, consumers will have a better perception of their brand and buy more. This feeling is shared by Coca Cola, who sees a bioplastic bottle as an ability to strengthen their brands’ connection to customers and consumers.

Companies as large as Coca Cola and Pepsi also face challenges in implementing a bioplastic bottle. According to Professor Colleen Twomey, because these companies produce a large volume of products, an issue that stands as a barrier to implementing bioplastic is the availability of resources. In making a bioplastic bottle, Coca Cola must have the resources for all the volume they produce. According to the research from Allen Hershkowitz mentioned above, using crops such as sugar cane or corn that are grown specifically for plastic production causes a lot of land conversion, affects the price of food, and uses a lot of fertilizer.

In addition to availability of resources, Dr. Jay Singh and Professor Colleen Twomey believe that cost is one of the biggest reasons why a company may not use bioplastic. Although

Coca Cola and Pepsi have been able to implement bioplastic bottles, the investment has been a large sum of money that many smaller companies cannot afford to undergo. Coca Cola believes that the cost of plant-based material will be more stable than the price of petroleum used to make conventional plastics (The Coca-Cola Company, 2012). However, at this time, they are absorbing the additional costs in order to fulfill their sustainability goals. Therefore, as Dr. Malcolm Keif said, right now there is no direct financial benefit in switching to bioplastic. The benefit is more about being a good steward of the Earth. Although many smaller companies would like to do the same, they often cannot absorb these additional costs. These findings show similarity to the beliefs of Dr. Malcolm Keif, Professor Colleen Twomey, and Dr. Jay Singh, that the size of a company does play a factor in its ability to implement more sustainable packaging. As mentioned by Dr. Jay Singh and Professor Colleen Twomey, larger companies often have the benefit of having access to resources and the ability to experiment on a larger scale because they can bear significant costs more easily. Because Pepsi is one of the world's largest food and beverage businesses, it is in the position to source agricultural byproducts from their own food business to manufacture a more "environmentally-preferable" bottle ("PespsiCo Develops," 2011). Coca Cola has the ability to experiment on a larger scale with packaging innovation teams that invest time and money to work on technology such as developing PTA (purified terephthalic acid) from plants.

Conclusion

The purpose of this study was to discover the reasons for why a company would not implement sustainable beverage packaging in the form of recycled material and/or bioplastic and whether or not these reasons are influenced by the size of a company.

A professional face-to-face interview was carried out with four industry professionals with experience in the packaging and printing industries. A series of questions was given to collect quantitative data related to the status of the beverage packaging industry in relation to implementation of recycled plastic and bioplastic solutions. After conducting the four interviews it was found that currently the most commonly used current beverage packaging material, PET (polyethylene terephthalate), is a polymer that provides great transparency, flexibility, strength, recyclability, and it cost effective. However, because this material is petroleum based, it negatively affects the environment. In order for conventional plastics like PET to be replaced, recycled content and bioplastic must be able to provide the same qualities. However, 100% recycled content results in a noticeable difference in clarity, which affects the visual appeal and brand image of the bottle. Similarly, the use of bioplastic can affect the permeability, stackability, puncture and scratch resistance, melt strength, and printability of a bottle. These changes in properties can stand as barriers to companies implementing a bottle of high-recycled content or bioplastic. It was also found that cost of materials, investing in new technology, availability of resources, and difficulty in recycling serve as reasons for why a company may not implement bioplastic.

Overall, all industry professionals interviewed agreed that the size of a company plays a factor in its ability to implement more sustainable packaging. While most professionals agreed that larger companies are better able due to accessibility to resources and ability to experiment

on a larger scale because they can bear significant costs more easily. Some professionals felt that smaller companies might have more room to experiment and may find it easier to pass along increased costs because their target market may be inclined to buy sustainable products.

Lastly, most of the professionals interviewed felt that from a financial standpoint, profit could be generated in switching from conventional plastic to recycled plastic and bioplastic in that companies might bring in more sales as they take on a new more sustainable brand image. One industry professional felt that, as of right now, there is no financial benefit from switching to bioplastic. The benefit right now is more about bettering the environment.

In order to obtain first-hand information as to why companies have or have not implemented sustainable beverage packaging, as well as whether or not their size plays a factor in their ability to implement more sustainable packaging, Honest Tea, a bottled iced tea company located in Bethesda, Maryland, was contacted via email and given a set of questions. From the responses received it was found that most of Honest Tea's products are made from PET using the injection molding process. All of their materials have some portions of post-consumer recycled content. However, they do not make a bottle out of 100% recycled content because of the inability to create a clear bottle out of 100% recycled content, which would make it difficult for their consumers to see the beverage inside. Honest Tea would like to produce a bioplastic bottle, however has expressed that is not commercially feasible at the time due to its tea brewing process.

Honest Tea feels their size does play a factor in their ability to implement more sustainable packaging. They feel that larger companies benefit from lower costs/prices due to higher volume of products sold. Therefore, because they are a smaller company with 115 employees, they do not have enough influence to bring costs down to a feasible level.

Lastly, they feel that, in theory, they might see an increase in sales in moving to bioplastic. However, due to an increase in material costs, they cannot say for sure that profit would be generated in switching from conventional to bioplastic.

In comparing responses between the industry professionals interviewed and the responses from Honest Tea it was found that transparency is altered when increasing the recycled content of a bottle, which is often an important feature to companies that would like to maintain the visual appeal and brand image of the bottle. Almost all beverage companies use a portion of recycled-content in their products. However, the amount used is usually the maximum amount possible while still meeting their “aesthetic, quality, and safety standards” (Honest Tea, 2013).

Almost all industry professionals agreed that the percentage of beverage packaging companies that have implemented a bioplastic product are very low. While Honest Tea uses recycled content in its products, it does not use bioplastic. The main reasons for why the company has not implemented a bioplastic bottle line up with the answers given by the industry professionals, who felt that cost and size of a company affect its ability to implement more sustainable packaging. Due to its smaller size, Honest Tea does not benefit from the lower costs and prices that come with higher volumes of products sold and therefore, does not have the influence to bring costs down to a level where they can implement bioplastic. Honest Tea and the industry professionals interviewed agreed that switching to bioplastic could bring in more sales by appealing to environmentally friendly consumers. However, due to such factors as increased material costs, it is hard to say whether there is financial benefit in switching to bioplastic at the moment.

Lastly, research was conducted to determine what specific beverage companies have changed in materials and design over the past ten years, for what reasons, and the challenges in

implementing such sustainable solutions. Companies of varying sizes were researched in order to draw conclusions between size of a company and ability to implement sustainable beverage packaging. It was found that companies such as Coca Cola and Pepsi have implemented bioplastic bottles. Pepsi unveiled a 100% plant based bottle. The bottle is made from switch grass, pine bark, corn husks, and other materials (“PepsiCo Unveils,” 2011.) Eventually Pepsi would like to also use orange peels, oat hulls, potato scraps, and other leftovers from its food business (“PepsiCo Unveils,” 2011). Coke’s PlantBottle is made of 30% plant-based material using sugarcane grown in Brazil (Neuman, 2012). However, scientists are still trying to determine how to make the remaining 70% on an industrial scale (Neuman, 2012). While research was found on larger companies implementing bioplastic, little to none was found on smaller companies implementing bioplastic.

From these results, it was determined that at this time, larger companies are better able to utilize bioplastic technology due to their ability to experiment on a larger scale and better access to resources at lower costs, which comes with higher volumes of products sold. To companies that have not implemented bioplastic bottles, cost and changes in the properties of the bottle act as barriers to implementation.

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Appendix A

Industry Professional Questions

1. What types of materials are used in beverage packaging?
2. What qualities do they have that make them suitable for beverage packaging? For the specific product? (carbonated drinks, juice, water, milk)
3. What process is used to make them?
4. What is the most commonly used bioplastic? (PLA, PHA)
5. Where are sustainable packages made? Are they made using the same process as conventional plastic?
6. What percentage of beverage companies would you say are using recycled materials or bioplastic?
7. How does the use of recycled plastic or bioplastic affect the properties of the bottle?
8. What are reasons for why a company may not use recycled plastic?
9. What are reasons for why a company would decide to use recycled plastic or bioplastic?
10. Does the size of a company play a factor in ability to implement more sustainable packaging?
11. From a financial standpoint, where is profit generated through switching from conventional plastic to recycled if at all?

Appendix B

Beverage Companies

Company Name: _____

1. What type of beverage products do you produce?
2. What type of material(s) are your products made of?
3. What process is used to make them?
4. Do you use either recycled plastic and/or bioplastic?
 - a. If so, what are the main reasons for why you have chosen to do so? What are the main reasons why a company may not choose to use recycled plastic and/or bioplastic?
 - b. If not, what are the main reasons why you have chosen not to?
5. How many employees do you have?
6. Does the size of your company play a factor in your ability to implement more sustainable packaging in the form of recycled plastic or bioplastic? How?
7. From a financial standpoint, where is profit generated through switching from conventional plastic to recycled, if at all?